Canadian Stock Assessment
Proceedings Series 99/17

Évaluation des stocks canadien
Séries des comptes rendus 99/17

Report of the PSARC Habitat Subcommittee Meeting June 15-16, 1999

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Pacific Biological Station
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September, 1999

Fisheries and Oceans Canada
Science

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Sciences

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102-01181/

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PSARC ADVISORY DOCUMENT 99-6
SEPTEMBER 1999

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SUMMARY

The PSARC Habitat Subcommittee met June 15-16, 1999 at the Institute of Ocean Sciences (IOS) in Sidney. The Subcommittee formally reviewed one Working Paper and two reports. A third Working Paper, "Scientific concepts for ecosystem based management of marine invertebrates on Canada's Pacific Coast", was presented to the Subcommittee, for information only, by Dr. Ian Perry. The Paper's concepts and conclusions were strongly supported by the Subcommittee, with Glen Jamieson recommending the first study to take place in an intertidal zone fishery.

Dr. Paul Leblond, of Pacific Fisheries Resource Conservation Council (PFRCC), attended the meeting as an external participant.

INTRODUCTION

The Subcommittee Chair, John Pringle, opened the meeting by welcoming the participants. During the introductory remarks the objectives of the meeting were reviewed, and the Subcommittee accepted the meeting agenda (Appendix 1). A list of meeting participants is included as Appendix 2.

WORKING PAPER SUMMARIES, REVIEWS AND DISCUSSION

Hab99-1 The effects of sediment on fish and their habitat

I.K. Birtwell **Accepted subject to revisions**

Summary

This document provides information and comments on guidelines and criteria for the protection of aquatic resources from elevated levels of suspended and deposited sediment in fresh water.

Elevated levels of sediment and turbidities can reduce the productivity of aquatic systems. Both these correlated factors have the potential to decrease primary productivity that may have consequences to secondary productivity and the energy flow to higher trophic levels.

Examples of the lethal and sublethal effects of sediment on fish and their habitat, and factors such as temperature, particle size and angularity, and duration of exposure, that influence these effects, are presented. Levels of suspended sediment that have been determined to be acutely lethal to fish typically range from the hundreds, to hundreds of thousands of $mg \cdot L^{-1}$ sediment, while sublethal

effects are often manifest in the tens to hundreds of $mg \cdot L^{-1}$ sediment.

Guidelines that rely on gravimetric determination of suspended sediment concentrations are recommended for use over those that rely solely on turbidity. However, if the relationship is known between these variables, then turbidity may be used as a surrogate for suspended sediment. The use of guidelines that incorporate the duration of exposure to sediments provide useful analytical information for predictive purposes, but caution is warranted over the use of this approach when attempting to predict the effects of low ($\leq$ tens of $mg \cdot L^{-1}$) levels of sediment over protracted periods of time. Guidelines that rely on the volumetric determination of "settleable solids" are not endorsed for use because of difficulties in obtaining a meaningful and generally applicable relationship between this variable and suspended solids.

It is concluded that elevated levels of sediment (typically over background) may be harmful to fish (i.e. acutely lethal, or elicit sublethal responses that could compromise their well-being and jeopardise survival), and in addition, negatively impact on their habitat.

Reviewer #1

Reviewer 1 felt the author produced a very effective synthesis of suspended sediments on salmonids and their habitat. Historical and current regulatory criteria have been examined as they relate to toxicological and sublethal effects on fish themselves and on their habitat and aquatic productivity. This reviewer complimented the author for providing fair consideration to dissenting views and noted that there were no notable deficiencies in the examined literature.

Reviewer 1 found the "Conclusions" a bit thin and suggested they be enhanced to better reflect the material covered.

Reviewer #2

Reviewer 2 felt this Working Paper provided a considerable amount of information in a modest number of pages. It is clear, easy to read and understand, and deserves publication and use by managers.

Reviewer 2 felt that the purpose of the paper was clearly stated, however, it was urged that the author begin with a more neutral introductory sentence.

This reviewer felt that the working paper is a review publication, thus there is little 'methodology' involved other than searching for publications and collating comments by topic area. The overall approach and format is acceptable.

Reviewer 2 suggested that a glossary of meanings be constructed for terms such as "suspended sediments", "turbidity", etc.

This reviewer felt that the Conclusion section summarized the material reviewed fairly and succinctly, however, there should be a more exhaustive review of local publications, particularly from the Carnation Creek work; i.e. Berg and Northcote (1985), and Shortreed and Stockner (1983), etc.

Reviewer 2 also suggested that a more in depth discussion of the key Newcombe and Jensen (1996) paper be added along with a discussion of the merits of the laboratory-based studies in relation to *in situ* conditions.

Reviewer 2 noted that this Working Paper provided no recommendations since it is a review, and its benefits lie in the conclusions, which have improved our understanding of this complex issue.

Subcommittee Discussion

The Subcommittee recommended that the working paper be revised to include a discussion, which considers the complexity of the topic and qualifies or interprets the vast amount of information in a manner which allows future management actions or research direction to be better evaluated and recommendations established.

The Subcommittee noted that it is the application of criteria that is potentially contentious, not the criteria themselves which have been proposed by different models, and this needs to be clarified in the working paper.

The Subcommittee agreed that overall ecosystem perspectives should be expanded and those parts of the models which are supported by the author should be better detailed.

The Subcommittee noted a problem with sublethal effects, and how they should be measured and dealt with by managers.

The Subcommittee noted that the paper only considers applications to freshwater. An additional working paper would be required to consider the effects of sediments in the marine environment.

Subcommittee Recommendations

The paper is accepted subject to revision.

The Subcommittee recommended that:

1) Habitat managers now clarify specific questions or issues they feel are important to address, given this review;
2) The relationship between NTU's (Nephelometric Turbidity Unit; a measure

of turbidity) and suspended solids be determined *a priori* for each watershed where their use is planned as the relationship varies with local conditions;

3) It be determined if current guidelines/regulations adequately consider the impact of sediments and their sublethal effects on fish; and also, how sublethal effects and their impact on ecosystem function should be dealt with under the precautionary approach (the current focus is on LC50's, which considers direct mortality of a single fish species only) and;

4) It be determined if receiving water guidelines, and their respective scientific underpinnings, should be reviewed by PSARC.

Report #1 Salmon habitat indicators and data sharing workshop

Sponsored by: Fish Habitat Inventory & Information Sharing Working Group, Habitat Protection Implementation Team, Canada-B.C. Pacific Salmon Fishery Agreement.
Prepared by: Eclipse Environmental Consulting Ltd.

Background

Canada and British Columbia signed a Memorandum of Understanding in 1996, dealing with roles and responsibilities in managing the Pacific salmon fishery. In addition, Fisheries and Oceans Canada established the Pacific Fisheries Resource Conservation Council (PFRCC), which advises the Minister on conservation and sustainable use of salmon resources and habitat. One Council task is an annual report on the state of salmon and salmon habitat in the Province.

The Council's Habitat Protection Implementation Team, in dealing with one Agreement requirement, agreed to develop a habitat inventory standard. To this end a Fish Habitat Inventory and Information Sharing Working Group was formed.

Issues

The Working Group, focussing on the data underpinnings for the Council's annual report on state-of-salmon-habitat, sponsored a two day "Salmon Habitat Indicators and Sharing Workshop" at the Institute of Ocean Sciences on April 22-23 1998. Workshop objectives were:

- to list a small suite of trend indicators for salmonid freshwater habitat; and
- to develop a process for accessing and evaluating supporting data.

Twenty-four fisheries managers, biologists and information technicians participated from the B.C. Ministries of Fisheries; Forests; and Environment, Lands and Parks (MELP); and Fisheries and Oceans Canada.

The Workshop Report (1998), prepared by Eclipse Environmental Consulting Ltd., and based on the keynote presentations, general discussion, and group break out sessions, was presented to PSARC's Habitat Subcommittee.

Approach

The Workshop built on the work of the Pacific Northwest Environmental Indicators (PNEI) Working Group of the Environmental Directors of the Pacific Northwest (B.C., Alaska, Oregon, Washington and Idaho). Two reports were reviewed: "The Salmon Habitat Indicators Workshop Proceedings" (1997) and "Towards a 'small but powerful' set of Regional Habitat Indicators for the Pacific Northwest" (1998).

Other indicator initiatives of MELP, the Canada/BC Environmental Co-operative Council and those of other agencies were reviewed as well.

Following the lead of the PNEI Working Group, the Workshop focused on three categories of indicators; Water Quantity/Quality, Land Use/Land Cover, and Physical Habitat. Each indicator was judged against the following criteria and rated as either good, moderate, poor or unknown:

- Degree of representativeness;
- Response to change;
- Understandable;
- Relevance to policy;
- Use by other jurisdictions;
- Association with targets or thresholds;
- Scientific support; and
- Adequacy of data base.

The last criterion above, "adequacy of data base", was rated as either good, moderate, poor or unknown using the following:

- Data coverage over time;
- Data coverage in space: regional, provincial, national, and international;
- Data methods: reliability, collection, storage, analysis, precision/Accuracy, and Quality Assurance/Quality Control;
- Data Source: Provincial, Federal and Municipal governments;
- Data availability: update frequency, media and format, documentation, organization, access, cost, and policy restrictions; and
- Data expertise (availability), production, and interpretation.

Results

Starting with the list of indicators chosen by the Pacific Northwest Environmental

Indicators Working Group, the Workshop participants ranked the following fifteen indicators as "high".

Water Quantity or Quality

1) Instream Flow: Waterbodies with sufficient Mean Annual Flow (MAD) to meet salmonid requirements.
2) Water Temperature: Waterbodies with maximum daily temperatures that cause impairment (moderate, severe) to salmonids.
3) Chemical Water Quality Index: As per the measurements of the B.C. Water Quality Index and Objectives for Aquatic Organisms.

Land Use or Land Cover

4) Land Use Conversion: Number of acres of selected watersheds that were converted from one land use/land cover classification (especially flood plains and riparian areas) to another.
5) Effective Impervious Surface: Percent impervious surface (roads, rooftops, parking lots, etc) in selected watersheds.
6) Slope failures: Number of slope failures in selected watersheds.
7) Channelization: Kilometers of stream channelized per geographical unit (undefined).
8) Wetland Area: Percentage of wetlands remaining in selected drainages.

Physical Habitat

9) Riparian Quality (land-water complex): Number of hectares of riparian habitat classified as altered or degraded in streams, lakes, estuaries, wetlands and off-channels.
10) Stream Status (land-water complex): Number of streams in selected watersheds classified as endangered, threatened, wild or lost.
11) Stream barriers (Impediments): Number of stream barriers, both anthropogenic and natural, per selected watershed.
12) Stream Habitat Complexity (Morphology): Variance in stream thalweg depth in selected watersheds.
13) Channel Type/Condition (Morphology): Channel type and condition as measured by the Channel Assessment Procedure (CAP).
14) Large Woody Debris (Morphology): Counts of Large Woody Debris pieces by channel type for selected watersheds.
15) Sediment fate in stream channels (Morphology): Number of landslides or kilometers of altered streams per watershed.

Conclusions

- The Pacific Fisheries Resource Conservation Council will require performance indicators and supporting information about salmon and salmon habitat.

- Salmon and salmon habitat indicators must be simple, and easily understood tools of communication for politicians and the public, yet based on sound

science.

- Improved integration is required in terms of standardized inventories, ground truthing and data analyses for both data-collection groups and for those developing and reporting indicators.

- Further work on selected indicators is required to improve measurement and interpretation.

- Few indicators have adequate data sets; most require reworking along with an assessment of both data gaps and uncertainties.

Recommendations

- Indicators should focus initially on high priority "index" watersheds or eco-provinces; ones that also support the Georgia Basin Ecosystem Initiative and other urban salmonid initiatives.

- Coordinated direction from inter-governmental executives and managers is now required to decide how indicators and their data sets will be developed further.

Subcommittee Discussion

The Subcommittee noted that most land use activities impact salmon habitat, thus it is imperative that the status of this habitat over time is understood. The Department, its partners and other government agencies are spending considerable resources on initiatives thought to conserve, enhance and restore habitat. They, along with the Pacific Fisheries Resource Conservation Council and stakeholders, are interested in the efficacy of actions aimed at protecting or restoring habitat, and the status of salmon habitat.

The Subcommittee noted that ecosystems are usually complex structures, and for most, understanding is not yet sufficient to identify indicators that can be guaranteed to monitor ecosystem health. However, it was agreed that indicators are used for characterising complex systems, (i.e. El Nino), and that integrative measures of ecosystem health are required to support policy and planning objectives and public communication. It was further recognized that regulatory and research activities need to support policies such as the recent draft Wild Salmon Policy, No Net Loss, etc. A specific requirement is for objective, repeatable measures of the quantity and quality of habitat that supports salmon.

The Subcommittee agreed that indicators are integrative by nature, but some of those presented in the report would be better classified as forcing measures.

The Subcommittee noted that habitat data can be used to measure and explain change in population abundances by separating natural from anthropogenic causes, to report on habitat status, to assist in land use planning, and to provide baseline data for enforcement.

Subcommittee Recommendations

The Subcommittee recommended:

1) The Department develops both quantitative and qualitative indicators of salmon freshwater habitat health that are scientifically defensible.
2) A framework document be developed that includes a well-defined set of objectives that both guides indicator selection, and recognizes the linkages between indicators and ecological processes.
3) Approaches for validating proposed indicators be explored, including their assessment in intensively studied systems such as index/pilot watersheds.

Report #2 Science in support of existing salmonid aquaculture siting guidelines

Workshop report by W. Knapp and J. Pringle

Summary

The objective of the workshop was to assess the Department's aquaculture siting guidelines in relation to the following: a) the rationale for each criterion (i.e. habitat, fish health), b) the adequacy of each criterion in meeting its objective, and c) the scientific support for the criteria.

The workshop evaluated the following four siting criteria:

- A fish farm should be located no closer than 1 km radius from the mouth of anadromous fish bearing streams. Distances may be adjusted depending on abundance of wild fish populations;

- Salmon net pens should not be located within 1 km of herring spawning areas designated by Fisheries and Oceans Canada as "vital", "major" or important as per the classification of Spawning Areas of B.C. Herring. For sites proposed within areas designated as "sometimes important" or "minor", consultation with the local Fisheries and Oceans Canada office will be required to determine recent spawn distribution trends or to confirm the area classification;

- Net pens shall not be located within 125 m of molluscan beds where there are, or is the potential for, recreational, native food fish or commercial

fisheries or within 125 m of existing molluscan culture operations; and

- Net pens shall not be located over or within 50 m of areas of sensitive habitat as defined by Section 34(1) of the Fisheries Act. These areas include spawning, rearing, food supply and migration areas upon which fish and shellfish depend directly or indirectly to carry out their life processes.

Other Guideline criteria, such as those dealing with interference with fishery operations, vessel navigation and ecological reserves were not assessed.

The Workshop proposed an additional criterion dealing with the use of acoustic deterrent devices and other predator controls for marine mammals.

The Workshop concluded that:

- Criteria designed to protect both wild fish stocks and sensitive habitat from the impacts of salmon net pen culture are not scientifically based;
- Certain environmental data required to assist in assessing the impact of salmon net pen farming on both habitat and benthic communities, including a large sediment data base, have been collected by provincial personnel, but much of it has yet to be analyzed; and in addition,
- Data held by industry that would contribute to our understanding of aquaculture impacts have either not been analyzed and/or made available to Department staff.

The Region must decide if current guidelines meet requirements, or that there is indeed a need for scientifically defensible criteria. If the latter are deemed necessary, then an assessment of data requirements must be made and, where necessary, studies designed and funded to fill in data gaps.

The Workshop recommended the following studies in anticipation of the Department's decision to request scientifically defensible siting guidelines:

Criterion 1

- Conduct a retrospective analysis to discern the incidence of disease of cultured salmon in relation to the salinity of salmon farm waters.
- Assess the need for a habitat-related criterion for distance from net pen to anadromous fish-bearing streams, and if there is, what the appropriate distance should be.

Criterion 2

- Assess available data to determine the relationship between dissolved oxygen concentrations reduced by salmonid net pen waste and the viability of herring spawn.

Criterion 3

- Assess the basis for, and revise as appropriate, the current specified

minimum distance between fish farms and molluscan shellfish beds. Evaluate the UBC study supporting the Salmon Aquaculture Review recommended distance of 300 m.

Criterion 4

- Define "sensitive habitat" and re-evaluate the acceptability of the current 50-m distance criterion.
- Define fish habitat in relation to salmon net pens. Determine for this habitat those minimal cumulative impacts from these pens that would incur a HADD (Habitat Alteration, Disturbance or Destruction), and methods for quantifying these impacts.
- Are there minimal water depths and currents that should be prescribed for the siting of fish farms?

Subcommittee Discussion

The Subcommittee agreed that there were valid reasons to develop an aquaculture siting guideline. The existing four distance criteria in the siting guideline document were not scientifically supported and the Subcommittee agreed with the February 1998 workshop conclusions that the criteria are not scientifically based. The Subcommittee also concluded that criteria need to be revisited to allow for consideration of factors other than distance – these might include considerations such as current velocities, mixing capability and so on. Finally, the Subcommittee felt that the guidelines should be precautionary in nature and if variance from this goal were sought they should be supported by a scientific study funded by the proponent.

Subcommittee Recommendations

The Subcommittee recommended that where appropriate, aquaculture siting guideline criteria be supported scientifically.

Appendix 1: PSARC Habitat Subcommittee Meeting Agenda, June 15-16, 1999.

Agenda for PSARC Habitat Subcommittee Meeting June 15-16, 1999

1. Review of agenda and minutes of February 10 meeting. J. Pringle
2. Review of meeting procedure. M. Stocker
3. Review of working paper, "The effects of sediment on fish and their habitat." I. Birtwell
4. Review of conclusions from the workshop report, "Salmon habitat Indicators and data sharing workshop." B. Smiley and R. Smith.
5. Review of conclusions from the workshop report, "Science in support of salmonid aquaculture siting guidelines." W. Knapp and J. Pringle
6. Presentation of "Scientific concepts for ecosystem-based management of marine invertebrates on Canada's Pacific Coast" by I. Perry
7. Review of Habitat status reports
8. Topics, proposed working papers and their respective authors and date of next Subcommittee meeting.

Appendix 2: List of Participants at Habitat Subcommittee Meeting, June 15-16, 1999

Name	Affiliation
R. Addison*	DFO, Marine Environment and Habitat Sciences Division, IOS
I. Birtwell*	DFO, Marine Environment and Habitat Sciences Division, West Vancouver Lab
P. Delaney*	DFO, Habitat and Enhancement Branch, Vancouver
K. Denman	DFO, Ocean Sciences and Productivity Branch, IOS
G. Ennis*	DFO, Habitat and Enhancement Branch, Vancouver
J. Hume*	DFO, Marine Environment and Habitat Sciences Division, Cultus Lake Laboratory
B. Holtby	DFO, Stock Assessment Division, PBS
G. Jamieson	DFO, Marine Environment and Habitat Sciences Division, PBS
T. Johnston*	B.C. Ministry of Fisheries
W. Knapp*	DFO, Habitat and Enhancement Branch, Vancouver
R. Lauzier*	DFO, Stock Assessment Division, PBS
P. LeBlond	Pacific Fisheries Resource Conservation Council
I. Perry	DFO, Stock Assessment Division, PBS
J. Pringle* (Subcommittee Chair)	DFO, Marine Environment and Habitat Sciences Division, IOS
S. Samis*	DFO, Habitat and Enhancement Branch, Vancouver
B. Smiley	DFO, Marine Environment and Habitat Sciences Division, IOS
R. Smith	Ministry of Environment, Lands and Parks, Victoria
G. Steer*	DFO, Habitat and Enhancement Branch, Vancouver
M. Stocker (PSARC Chair)	DFO, Chair, Pacific Scientific Advice Review Committee, PBS

* Subcommittee Members